

AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions and listings of claims in the application.

Listing of Claims:

1. (Original) An aberration measuring apparatus comprising:

a converging lens disposed on the light path of light beam to converge light beam traveling through a measurement target optical system on a predetermined surface;

an aperture stop disposed on the light path of light beam to transmit a part of the light beam;

a moving unit connected the aperture stop to move said aperture stop within the light beam;

a converging position detection unit disposed on the predetermined surface to detect a positional deviation of a converging position of a part of the light beams traveling through said aperture stop on the predetermined surface;  
and

an arithmetic processing unit connected the converging position detection unit to calculate an aberration of said measurement target optical system on the basis of an output signal from said converging position detection unit.

2. (Original) An aberration measuring apparatus according to claim 1, wherein said converging lens converges a part of the light beams, and

said moving unit moves said converging lens integrally with said aperture stop in the direction intersecting the optical axis of the light beam.

3. (Original) An aberration measuring apparatus that measures an aberration of a projection optical system that transfers onto a substrate, an image of a predetermined circuit pattern formed on a mask, comprising:

an aberration measuring optical system disposed on the object plane side of the projection optical system to emit a light beam which measures the aberration upon said projection optical system;

a plurality of lens elements, two-dimensionally arrayed, disposed on the image plane side of the projection optical system to converge the light beams through said projection optical system;

a converging position detection unit disposed on the image plane of the lens elements to detect each of positions of the light beams converged by said plurality of lens elements; and

a measuring device connected the converging position detection unit to measure the aberration of said projection optical system on the basis of the converged light positions detected by said converging position detection unit.

4. (Original) An aberration measuring apparatus according to claim 3, wherein said aberration measuring optical system includes:

a mask which measures the aberration, disposed substantially in the same position as said mask formed with the predetermined circuit pattern is disposed and having a pinhole pattern; and

an illumination optical system that illuminates said mask which measures the aberration with the light beam.

5. (Original) An aberration measuring apparatus according to claim 4, wherein said illumination optical system is an illumination optical system that illuminates the predetermined circuit pattern with the light beam.

6. (Original) An aberration measuring method comprising:

converging light beam traveling through a measurement target optical system on a predetermined surface by the use of a converging lens;

making an aperture stop transmit a part of the light beam;

moving said aperture stop within the light beam;

detecting a positional deviation of each of a converging position of a part of the light beam traveling through said aperture stop on the predetermined surface by the use of a converging position detection unit; and

calculating an aberration of said measurement target optical system on the basis of an output signal obtained in said converging position detecting step.

7. (Original) An aberration measuring method according to claim 6, wherein a part of the light beam is converged in said converging step, and

said converging lens is moved integrally with said aperture stop in the direction intersecting the optical axis of the light beam in said moving step.

8. (Original) An aberration measuring method of measuring an aberration of a projection optical system that

forms, on a substrate, an image of a predetermined circuit pattern formed on a mask through the projection optical system, comprising:

converging the light beams which measures the aberration that have passed through said projection optical system by the use of a plurality of lens elements;

detecting each of positions of the light beams converged by said plurality of lens elements; and

measuring the aberration of said projection optical system on the basis of the detected light positions.

9. (Currently Amended) An aberration measuring method according to claim 8, wherein the light beam which measures the aberration is light beam from a pinhole pattern on a mask, ~~which measures the aberration, that is~~ disposed substantially in the same position as the said mask is disposed.

Claims 10-26 (Cancelled)

27. (Original) An aberration measuring apparatus that measures an aberration of a projection optical system

which transfers onto a substrate an image of a pattern formed on a mask, comprising:

a measuring unit detachably provided on an exposure apparatus including a mask stage which holds said mask, said projection optical system, and a substrate stage which holds said substrate,

wherein said measuring unit includes:

a plurality of lens elements, two-dimensionally arrayed, disposed on the image plane side of the projection optical system to converge the light beams through said projection optical system;

a converging position detection unit disposed on the image plane of the lens elements to detect each of positions of the light beams converged by said plurality of lens elements; and

a measuring device connected the converging position detection unit to measure the aberration of said projection optical system on the basis of the light positions detected by said converging position detection unit.

28. (Currently Amended) An aberration measuring apparatus according to claim 27, further comprising an

aberration measuring optical system ~~through which emits the~~  
light beam for measuring ~~which measures the aberration upon~~  
~~fall on said projection optical system,~~

wherein said measuring unit is detachably held on said  
substrate stage, and

said aberration measuring optical system is provided  
on said mask stage.

29. (Currently Amended) An aberration measuring  
method which measures an aberration of a projection optical  
system incorporated into an exposure apparatus which  
transfers onto a substrate an image of a pattern formed on  
a mask, comprising:

disposing an aberration measuring optical system, to  
~~emits~~ emit a light beam which measures the aberration upon  
said projection optical system, substantially in the same  
position as said mask is disposed; and attaching, to a  
substrate stage which holds said substrate, a measuring  
unit including:

a plurality of lens elements disposed on the image plane  
side of the projection optical system to converge the light  
beams through said projection optical system; a converging  
position detection unit disposed on the image plane of the

lens elements to detect each of positions of the light beams converged by said lens array; and a measuring device connected to the converging position detection unit to measure the aberration of said projection optical system on the basis of the light beam positions detected by said converging position detection unit.

30. (Currently Amended) An aberration measuring method according to claim 29, further comprising:

removing said aberration measuring optical system after having emitted the light beam which measures the aberration onto ~~have fallen upon~~ said projection optical system; and

removing said measuring unit from said substrate stage after measuring the aberration of said projection optical system.

Claims 31-32 (Cancelled)

33. (Original) An aberration measuring method according to claim 8, further comprising a step for correcting the measured aberration of said projection optical system.



Claim 34 (Cancelled)

35. (Currently Amended) An aberration measuring apparatus which measures an aberration of a projection optical system which transfers onto a substrate an image of a pattern formed on a mask, comprising:

a measuring unit detachably provided on an exposure apparatus including a mask stage which holds said mask, said projection optical system, and a substrate stage which holds said substrate,

wherein, said measuring unit includes:

a plurality of lens elements, two-dimensionally disposed, disposed on the image plane side of the projection optical system to converge the light beams through said projection optical system;

a converging position detection unit disposed on the image plane of the lens elements to detect each of positions of the light beams converged by said plurality of lens elements; and

an output unit connected to ~~which outputs a result of the detection by said converging position detection unit to~~ a correcting mechanism which corrects ~~for correcting the~~

aberration of said projection optical system to output a  
result of the detection by said converging position  
detection unit to said correcting mechanism.